iii) a third lens group having positive refractive power,

iv) a fourth lens group having negative refractive power and a first aspherical surface,

v) a fifth lens group having positive refractive power and an aperture stop,

vi) wherein the projection optical system is designed such that paraxial rays traveling parallel to the optical axis imagewise to objectwise intersect the optical axis at a location Q between said fourth lens group and said fifth lens group,

vii) at least one of said fourth and fifth lens groups includes a second aspherical surface arranged between said first aspherical surface and said aperture stop,

viii) said fifth lens group includes a third aspherical surface arranged imagewise of said aperture stop, and

A2 Cont.

C

ix) wherein the following condition is satisfied:

$0.01 < d_Q/\{L \times (1\text{-}NA)\} < 0.4$

wherein the image and the object are separated by a distance L, said location Q and said aperture stop are separated by a distance d_Q, and NA is an imagewise numerical aperture of the projection optical system; and

c) exposing said photosensitive workpiece over an exposure field.

17. (Amended) A device manufacturing method comprising the steps of:

a) coating a photosensitive material onto a substrate;

b) projecting onto said substrate the image of a pattern of a reticle through [the] a projection optical system, [set forth in claim 1] said projection optical system comprising, along an optical axis:

i) a first lens group having positive refractive power,

ii) a second lens group having negative refractive power,

iii) a third lens group having positive refractive power,

iv) a fourth lens group having negative refractive power and a first aspherical surface,

v) a fifth lens group having positive refractive power and an aperture stop,

vi) wherein the projection optical system is designed such that paraxial rays traveling parallel to the optical axis imagewise to objectwise intersect the optical axis at a location Q between said fourth lens group and said fifth lens group,

A2 cont

vii) at least one of said fourth and fifth lens groups includes a second aspherical surface arranged between said first aspherical surface and said aperture stop,

C

viii) said fifth lens group includes a ~~third~~ aspherical surface arranged imagewise of said aperture stop, and

ix) wherein the following condition is satisfied:

$0.01 < d_Q/\{L \times (1\text{-}NA)\} < 0.4$

wherein the image and the object are separated by a distance L, said location Q and said aperture stop are separated by a distance d_Q, and NA is an imagewise numerical aperture of the projection optical system; and

c) developing said photosensitive material on said substrate, thereby forming a photoresist pattern.

31. (Amended) A method of patterning a photosensitive workpiece over an exposure field with a pattern present on a reticle, the method comprising the steps of:

A3 C

a) illuminating the reticle with light;

b) projecting the light from the reticle with [the] a projection optical system, [as set forth on claim 8] the projection optical system comprising, objectwise to imagewise, along an optical axis:

(i) a first lens group having positive refractive power,

(ii) a second lens group having negative refractive power,

(iii) a third lens group having positive refractive power,

(iv) a fourth lens group having negative refractive power and a first aspherical concave surface with refractive power at a paraxial region and refractive power at a periphery, wherein said refractive power at said periphery is weaker than said refractive power at said paraxial region,

(v) a second aspherical surface arranged imagewise of said first aspherical surface and having refractive power at a paraxial region and refractive power at a periphery, and being one of:

(a) a convex surface, with said refractive power at said periphery weaker than said refractive power at said paraxial region, and

(b) a concave surface, with said refractive power at said periphery stronger than said refractive power at said paraxial region,

(vi) a fifth lens group having positive refractive power, an aperture stop, and a third aspherical surface arranged imagewise of said aperture stop, wherein said third aspherical surface includes a paraxial region, a periphery and refractive power and is one of:

A3 cont.

(a) a convex surface, with said refractive power at said periphery weaker than said refractive power at said paraxial region, and

(b) a concave surface, with said refractive power at said periphery stronger than said refractive power at said paraxial region, and

(vii) wherein the projection optical system is designed such that paraxial rays traveling parallel to the optical axis imagewise to objectwise intersect the optical axis at a location Q between said fourth lens group and said fifth lens group; and

c) exposing the photosensitive workpiece over the exposure field.

B3 Cont.

32. (Amended) A projection optical system [according to claim 1] comprising, along an optical axis:

i) a first lens group having positive refractive power,

ii) a second lens group having negative refractive power,

iii) a third lens group having positive refractive power,

iv) a fourth lens group having negative refractive power and a first aspherical surface,

v) a fifth lens group having positive refractive power and an aperture stop,

vi) wherein the projection optical system is designed such that paraxial rays traveling parallel to the optical axis imagewise to objectwise intersect the optical axis at a location Q between said fourth lens group and said fifth lens group,

vii) at least one of said fourth and fifth lens groups includes a second aspherical surface arranged between said first aspherical surface and said aperture stop,

viii) said fifth lens group includes a third aspherical surface arranged imagewise of said aperture stop, and

ix) wherein the following condition is satisfied:

$0.01 < d_Q/\{L \times (1\text{-}NA)\} < 0.4$

wherein the image and the object are separated by a distance L, said location Q and said aperture stop are separated by a distance d_Q, and NA is an imagewise numerical aperture of the projection optical system, wherein:

(a) said first aspherical surface is concave and includes refractive power at a paraxial region and refractive power at a periphery, wherein said refractive power at said periphery is weaker than said refractive power at said paraxial region;

A3 cont

(b) said second aspherical surface including refractive power at a paraxial region, and refractive power at a periphery, wherein said refractive power at said periphery is more negative than said refractive power at said paraxial region; and

(c) said third aspherical surface including refractive power at a paraxial region, and refractive power at a periphery, wherein said refractive power at said periphery is more negative than said refractive power at said paraxial region.

38. (Amended) A method of [pattering] patterning a photosensitive workpiece with a pattern present on a reticle, the method comprising the steps of:

A4

(a) illuminating the reticle with light from [said] an illuminating optical system of [said] an exposure apparatus, [of claim 35] the exposure apparatus comprising:

(i) a first stage designed so as to be movable along a scanning direction and to support the reticle,

(ii) the illuminating optical system adjacent said first stage arranged so as to illuminate the reticle with light,

(iii) a second stage designed so as to be movable along at least said scanning direction, for supporting the photosensitive workpiece,

(iv) a projection optical system, arranged between said first stage and said second stage, having a plurality of lenses and an aperture stop, said plurality of lenses and said aperture stop designed such that said light from said reticle is capable of being guided to an exposure field on said substrate with an imagewise maximum numerical aperture of at least 0.8, and

(v) wherein said exposure field has a first dimension orthogonal to said scanning direction, and a second dimension along said scanning direction, said first dimension is greater than said second dimension, and said first dimension is at least 15mm;

(b) projecting the light from the reticle with the projection optical system of said exposure apparatus [of claim 35]; and

(c) exposing said photosensitive workpiece over said exposure field.

REMARKS

Claims 16-18, 31, 32 and 38 are pending. By this amendment, claims 16, 17, 31, 32 and 38 are rewritten in independent form. These claims were withdrawn by the Examiner in the parent application as a result of a restriction requirement.

Examination and allowance of these claims in due course are earnestly solicited.

Respectfully submitted,

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Date: November 28, 2000

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